A Framework for the Organizational Assumptions Underlying Safety Culture

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Abstract. The safety culture of the nuclear organization can be addressed at the three levels of culture proposed by Edgar Schein. The industry literature provides a great deal of insight at the artefact and espoused value levels, although as yet it remains somewhat disorganized. There is, however, an overall lack of understanding of the assumption level of safety culture. This paper describes a possible framework for conceptualizing the assumption level, suggesting that safety culture is grounded in unconscious beliefs about the nature of the safety problem, its solution and how to organize to achieve the solution. Using this framework, the organization can begin to uncover the assumptions at play in its normal operation, decisions and events and, if necessary, engage in a process to shift them towards assumptions more supportive of a strong safety culture.

1. Introduction

The term Safety Culture was adopted by the IAEA in recognition of the fact that nuclear safety is heavily dependent on the actions and, therefore, the thoughts of people within the organization. The power of the concept lies in the notion of safety as cultural phenomenon: we know quite a lot about safety, we know quite a bit about culture, what happens when we combine the two?

Edgar Schein [1,2], one of the top thinkers on the subject, proposes three levels of organizational culture:

(a) artefacts: "visible organizational structures and processes...all the phenomena that one sees, hears and feels..."
(b) espoused values: "strategies, goals, philosophies..." - what the organization says about itself.
(c) underlying assumptions: "unconscious, taken-for-granted beliefs, perceptions, thoughts and feelings...the ultimate source of values and action."

Since the inception of the safety culture concept, the IAEA, WANO, INPO, numerous regulatory bodies, as well as nuclear organizations, have all worked to determine what it actually means both in theory and in practice. The result in 2002 is a large collection of valuable, but partially inconsistent and overlapping, insights. The safety culture literature has much to say about the artefacts, espoused values and underlying assumptions supportive of safety, but is often confusing for not making the distinction between them.

2. Artefacts: The Defences

The majority of the industry literature addresses the artefact level of safety culture. These are the things that we actually *do* to ensure safe operation, including, for example, up-to-date procedures, conservative decision-making, open communication, self-checking, clear lines of authority, assessment & improvement processes, etc. Generally speaking, these are the defences that exist to safeguard the nuclear hazard. As such, they are the ultimate focus of a strong safety culture.

Much is known about the defences needed to maintain nuclear safety. Given the disorganization of the industry literature, however, it is recommended that operating organizations construct a coherent model of what safety culture means to them at the artefact level, so that they can perform self-assessments and upgrade their understanding as they progress.

3. Espoused Values

Espoused values are what the organization says it wants to be and do, usually generated by management. They often take the form of slogans, posters and mission statements designed to promote certain types of behaviour, attitudes or expectations. They can assist change by becoming a memorable

prompt to thought or action. It is obvious, however, that espoused values are not always matched by action; what we say we want is not always the same as what we actually do. [1,2,3]

Industry insights often enter organizations as espoused values. In particular, the standards and criteria set out by agencies such as the IAEA (OSART Guidelines) and WANO (Performance Objectives and Criteria (PO&Cs)) are intended to hold the status of espoused values. Sometimes these are readily adopted and quickly become artefacts. On occasion, however, changes that would serve to enhance safety fail to become standard practice. The key to understanding an organization's pattern of artefacts, as well as the means to change them, lies one cultural level down with the underlying assumptions.

4. Underlying Assumptions

Assumptions, as discussed here, are largely unconscious beliefs that are only made visible by interpreting observable patterns of behaviour. Assumptions exist in an organization in order to simplify what is otherwise an enormously complex reality [4,5]. The assumption 'people are generally good', for instance, can help people interpret the motives of others, make judgments about who to trust and shape the disciplinary process. Underlying assumptions in the organization have a significant impact on artefacts [1,2] and, therefore, on safety.

In order to be successful an organization has to solve certain problems, a process that can be supported, enhanced, endangered or stymied by the underlying assumptions of the organizational culture. As such, an organization's underlying assumptions can be separated into three types:

(a) assumptions about the problem – what is it we are trying to achieve?
(b) assumptions about the solution
(c) assumptions about how to organize in order to achieve the solution

4.1. Assumptions about the Problem

When it comes to the nuclear power industry, the significant (although not the only) problem is obviously safe operation. Industry experience suggests that the best way of conceptualizing this problem is in terms of *vulnerability*: we are vulnerable to the (enormously) harmful potential of the nuclear reactor. The original IAEA document on the subject states that the purpose of safety culture is "to establish that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance." [6] This is the starting point.

4.2. Assumptions about the Solution

Faced with this vulnerability, the nuclear organization holds a number of assumptions about how to deal with it, how best to solve the problem. Industry experience also has much to say on this score. It is commonly accepted that the best, indeed the only way to reduce vulnerability, is through the principle of *defence in depth*. "To compensate for potential human and mechanical failures, a defence in depth concept is implemented, centered on several levels of protection, including successive barriers preventing the release of radioactive material to the environment." [7]

The safety culture of the nuclear organization should, therefore, hold the assumption that defence in depth is the only means to maintain safety. All defences can be separated into one of three types: plant, process or people. The nuclear organization holds assumptions about the importance and state of each of these types of defences. Generally speaking, the organization should assume that each type of defence is important to nuclear safety and not let assumptions about the efficacy of certain defences reduce the overall assumption of vulnerability. Assumptions that would be indicative of a strong safety culture are:

- PLANT: The plant is an effective safety barrier if it is in the design condition and design configuration
- PROCESS: Processes are effective if they are specified, understood and followed

- PEOPLE: People are effective if they are trained and qualified and if they get specific personal performance feedback in adopting human performance practices
- DEFENCE IN DEPTH: The types of safety barrier are mutually interdependent, and consequently they cannot be traded off against each other.

These assumptions can be looked for in the day-to-day functioning of the organization. For example operation with degraded equipment in the absence of compensatory measures indicates that decision makers are not holding to the safety culture assumption about the plant barrier.

4.3. Assumptions about How to Organize

Given the understanding of the problem and the solution, the organization holds a set of assumptions about how best to go about achieving the solution. In close accordance with Edgar Schein's work [1,2,3], we suggest that there are six types of assumptions shaping the nature of the organization:

(a) action – assumptions about the sorts of things we should be doing
(b) information – assumptions about the accepted basis for judgments
(c) motivation – assumptions about how people are motivated and how to change behavior
(d) hierarchy – assumptions about the application of power in the organization
(e) leadership – assumptions about the role of leaders
(f) time – assumptions about the relationship between past, present and future

When it comes to the assumptions about how to organize, there are no inherently 'good' or 'bad' assumptions; the question is whether they are supportive or unsupportive of the organization's purpose. In terms of the nuclear organization, this set of assumptions should be firmly grounded in the assumptions about vulnerability and defence in depth.

5. What Can Go Wrong?

There are essentially two potential problems with an organization's set of underlying assumptions: an invalid assumption (or more than one) or an imbalance in the relationship between assumptions. [1,2]

The most damaging type of invalid assumption occurs when the organization has a faulty conception of the problem and/or the solution. In the context of the nuclear organization this would include such assumptions as 'the reactor is inherently safe' or 'it is okay to compromise one line of defence as long as others are maintained'. If the organization begins with invalid assumptions about the nature of and the solution to the safety problem, achieving a strong safety culture becomes impossible.

The relationship between assumptions is problematic if one assumption has an undue influence on other assumptions. If, for example, the organization holds an overly powerful assumption that 'the leadership must not lose face' other assumptions will come to be defined in terms of it. Thus an assumption about information might become 'valid information is that which supports management's position', which would, in turn, compromise accurate assumptions about the state of the plant. These overly powerful assumptions are 'black-holes'.

It is important to note that a black-hole assumption is not necessarily an invalid one. It is vital, for instance, that the nuclear organization have an assumption about the importance of the physical state of the plant as a defence. A problem results, however, if this overwhelms and undermines assumptions about the importance of process and people as defences, such that all assumptions about action, time, motivation, etc. revolve around the plant.

6. Changing the Culture

It is people's actual behaviours and the plant conditions that create or prevent events. The first step towards improvement is, therefore, to assess which artefacts require change by comparing what actually happens (artefacts) against espoused values such as the WANO PO&Cs. If new procedures, etc. are capable of fixing safety problems within the existing culture then there is no need to alter the

organization's underlying assumptions [2,3]. However, if there are incorrect or misaligned assumptions at play then the organization must set about changing them.

Assumptions are social phenomena. They are passed from person to person and organizational generation to generation, and are significant precisely because they are held by almost everyone. If assumptions are damaging to the organization's purpose, it is the task of the leadership to shift them. [1,2] Leaders can only achieve this by becoming aware of the faults of their own assumptions and targeting a very specific area for change. They must then constantly and persistently model, explain and demand a new way of perceiving, thinking and acting.

As is evident in the discussion above, assumptions impact on each other and the relationships between them are often more significant than their actual content. Assumptions breed assumptions. If, for example, the leadership exhibits the assumption that 'up-to-date information about the state of the plant is vital', it is logical for people to infer that 'the plant is not inherently safe, rather it must be maintained in a safe state.' It is this process of 'assumption-hopping' that leaders must capitalize on when embarking on a process of culture change.

When entering into a process of culture change, leaders have a choice: they can either attempt to change the content of an invalid assumption or they can try to shift the relationship between assumptions. When it comes to black-hole assumptions, it may make more sense to build-up another complementary assumption, rather than attack the overly-powerful, but often valid assumption.

Some techniques for shifting assumptions include:

(a) creating a framework and a vocabulary for discussing the underlying assumptions, together with phrases that describe the targeted 'old' and 'new' assumptions
(b) developing a method to reveal the assumptions that were at play in certain events and decisions
(c) reviewing certain plans or actions before execution to look for embedded assumptions (both the old and the new set)
(d) developing communication skills to reveal assumptions through stories and in discussions with staff

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